**1.**

    a) A permanent improvement in technology raises trend production and the natural level of production. What happens to the cyclical part (the trend deviation) depends on monetary policy but if the central bank keeps production at the natural level the cyclical part is zero.

    b) An earthquake which destroys some factories leads to a reduction in the natural level of production but should not affect the trend. If production is kept at the natural level, the cyclical part is negative, i.e. production is temporarily below its long run trend.

    c) A labour market reform which reduces the natural level of unemployment raises trend production and the natural level of production. If the central bank keeps production at the natural level the cyclical part is zero.

2. A permanent improvement in technology (a) or a labour market reform (c) will raise the natural level of production and higher expected income will shift the IS curve outwards. The central bank should keep production on the (higher) natural level. Whether the interest rate should be raised or reduced depends on which curve shifts most.
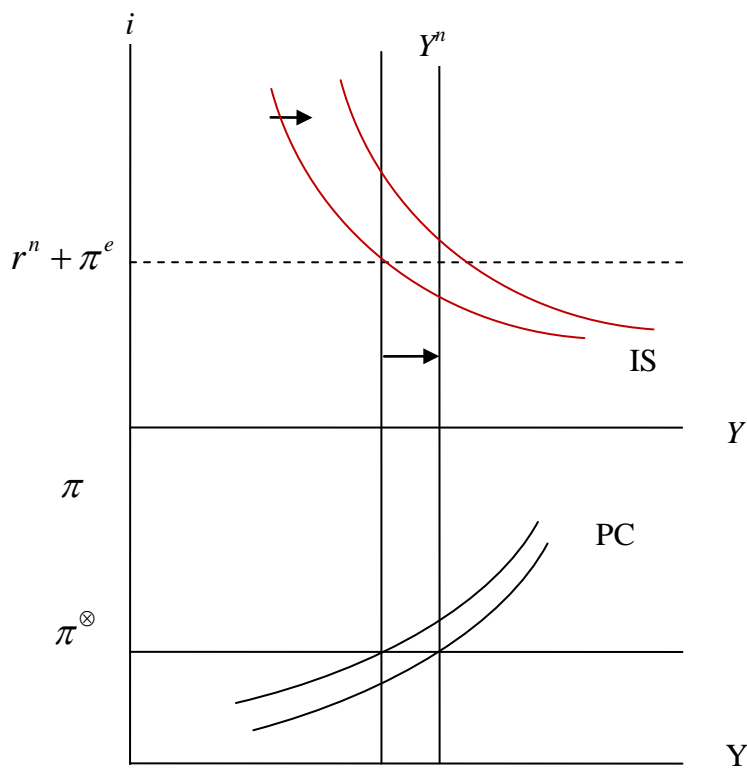
b) An earthquake which destroys some factories leads to a reduction in the natural level of production and since the fall in income is temporary, consumption should fall less than income. Also, there is a need for investment to replace demolished factories, so investment may increase. Thus we would expect the natural level of production to fall more than demand. In order to keep production on the natural level, the central bank needs to raise the interest rate.
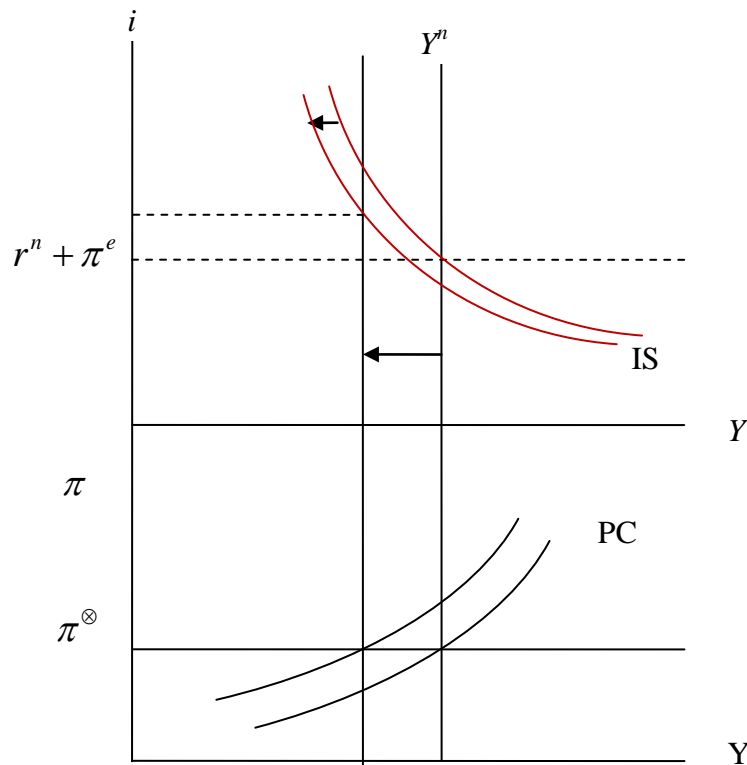
3. A typical trend deviation in private consumption leads to a reduction in aggregate demand of 0.9 percent $(0.60 \cdot 0.015 = 0.009)$. A typical trend deviation in private investment leads to a reduction in aggregate demand of 1.2 percent $(0.20 \cdot 0.06 = 0.012)$. Thus, investment contributes somewhat more to the volatility of demand.

4. All three mechanisms amplify effects of shocks. If, for some reason, there is an increase in production and income, this leads to a further increase in aggregate demand because of increased consumption and investment.

a) The multiplier effect differs from the accelerator effect because the former affects consumption while the latter affects investment (and consumer durables). Also, the multiplier effect arises because a higher *level* of income leads to higher consumption while the accelerator effect says that an *increase* in production leads to higher investment as firms need to increase their production capacity.

b) The accelerator effect and the financial accelerator effect are similar in that both affect investment. One difference, though, is that according to the accelerator effect, firms invest because of high *expected future demand* while the financial accelerator arises because high *current demand* raises profits and makes it easier to finance investments.

c) The multiplier effect and the financial accelerator effect differ in that the former affects consumers and consumption while the latter affects firms and investment. They are similar in that a high level of production and income generates high demand.

5.

a) On average, the chance to have a job and the level of income are the same but if I behave in line with consumption theory, I should prefer a smooth level of consumption to a fluctuating one.

b) Fluctuations should make it harder for firms to plan their production and this should lead to inefficiencies and a lower level of production. On the other hand, some economists (Marx and Schumpeter) have argued that recessions are good because they weed out weak firms and make room for new ones – so-called "creative destruction".

6. $0.47 \cdot 0.35 + 0.26 \cdot 0.12 + 0.20 \cdot 0.43 + 0.40 \cdot 0.53 = 0.49$
Imports should be 49 percent of GDP. According to the Table in Chapter 1 it was 46 percent of GDP in 2008. The share fluctuates a bit from year to year.

7.

a) $Y = C + I + G + X - q_C C - q_G G - q_I I - q_X X$

$$Y = \left(1 - q_c\right)\left(c_0 + c_1\left(Y - T_0 - \tau Y\right)\right) + \left(1 - q_I\right)I + \left(1 - q_G\right)G + \left(1 - q_X\right)X$$

$$Y = \left(1 - q_c\right)\left(c_0 - c_1 T_0\right) + \left(1 - q_c\right)c_1\left(1 - \tau\right)Y + \left(1 - q_I\right)I + \left(1 - q_G\right)G + \left(1 - q_X\right)X$$

$$Y = \frac{1}{1 - \left(1 - q_c\right)c_1\left(1 - \tau\right)}\left[\left(1 - q_c\right)\left(c_0 - c_1 T_0\right) + \left(1 - q_I\right)I + \left(1 - q_G\right)G + \left(1 - q_X\right)X\right]$$

b)

$$dY = \frac{1}{1 - \left(1 - q_c\right)c_1\left(1 - \tau\right)}\left(1 - q_G\right)dG = \frac{1}{1 - \left(1 - 0.35\right)0.8\left(1 - 0.54\right)}\left(1 - 0.12\right)dG = 1.314 \cdot 0.88\, dG = 1.16\, dG$$

$$dY = -\frac{1}{1 - \left(1 - q_c\right)c_1\left(1 - \tau\right)}\left(1 - q_c\right)c_1 dT_0 = -1.314 \cdot \left(1 - 0.35\right)0.8\, dT_0 = -1.314 \cdot 0.52 = -0.68\, dT_0$$

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$$dY = \frac{1}{1-(1-q_c)c_1(1-\tau)}(1-q_I)dI = 1.314 \cdot (1-0.43)dI = 1.314 \cdot 0.57\, dI = 0.75\, dI$$

$$dY = \frac{1}{1-(1-q_c)c_1(1-\tau)}(1-q_X)dX = 1.314 \cdot (1-0.40)dX = 1.314 \cdot 0.60\, dX = 0.79\, dX$$

Government expenditure has the strongest effect on demand because the import content of government expenditure is low. A tax reduction (negative dT_0) has the lowest effect because 20 percent of the tax reduction will be saved and 35 percent of the increase in consumption is directed towards imports. Increases in investment and exports also have effects well below unity because of the large import content in investment and exports. We see that the multiplier is quite different depending on where the original demand shock occurs.